

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (51) International Patent Classification <sup>6</sup> :<br><b>A01N 59/16, A61L 2/16, C23C 14/14</b>  |  | <b>A1</b>  | (11) International Publication Number: <b>WO 95/13704</b>   |
|  |  |  | (43) International Publication Date: 26 May 1995 (26.05.95) |
| (21) International Application Number: <b>PCT/CA94/00604</b>   |  | 3431 - 139 Avenue #215, Edmonton, Alberta T5Y 1Z4 (CA).  |   |
| (22) International Filing Date: 1 November 1994 (01.11.94)   |  | (74) Agent: OGILVIE AND COMPANY; #1400 Metropolitan Place, 10303 Jasper Avenue, Edmonton, Alberta T5J 3N6 (CA).  |   |
| (30) Priority Data:  |  | (81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ). |   |
| 08/154,490 18 November 1993 (18.11.93) US  |  |  |   |
| 08/154,693 18 November 1993 (18.11.93) US  |  |  |   |
| 08/154,694 18 November 1993 (18.11.93) US  |  |  |   |
| 08/190,617 2 February 1994 (02.02.94) US   |  |  |   |
| (71) Applicant (for all designated States except US): WESTAIM TECHNOLOGIES INC. [CA/CA]; Box 1000, 10101 - 114 Street, Fort Saskatchewan, Alberta T8L 2P2 (CA).  |  |  |   |
| (72) Inventors; and  |  |  |   |
| (75) Inventors/Applicants (for US only): BURRELL, Robert, Edward [CA/CA]; 112 Village Downs, Sherwood Park, Alberta T8A 4L6 (CA). APTE, Prasad, Shrikishna [CA/CA]; 34 Langholm Drive, St. Albert, Alberta T8N 3W1 (CA). GILL, Kashmir, Singh [CA/CA]; 58 Malvern Drive, Sherwood Park, Alberta T8A 3W1 (CA). PRECHT, Roderick, John [CA/CA]; 7877 - 26 Avenue, Edmonton, Alberta T6K 3S7 (CA). MORRIS, Larry, Roy [CA/CA]; Rural Route #2, Yarker, Ontario K0K 3N0 (CA). MCINTOSH, Catherine, Laurie [CA/CA]; 713 Georgian Terrace, Sherwood Park, Alberta T8A 2T7 (CA). SANT, Sudhindra, Bharat [CA/CA];   |  | Published<br>With international search report.   |   |
| (54) Title: ANTI-MICROBIAL MATERIALS   |  |  |   |
| (57) Abstract  |  |  |   |
| <p>Anti-microbial coatings and powders and method of forming same on medical devices are provided. The coatings are preferably formed by depositing an anti-microbial biocompatible metal by vapour deposition techniques to produce atomic disorder in the coating such that a sustained release of metal ions sufficient to produce an anti-microbial effect is achieved. Preferred deposition conditions to achieve atomic disorder include a lower than normal substrate temperature, and one or more of a higher than normal working gas pressure and a lower than normal angle of incidence of coating flux. Anti-microbial powders formed by vapour deposition or altered by mechanical working to produce atomic disorder are also provided. The anti-microbial effect of the coatings or powders may be further activated or enhanced by irradiating with a low linear energy transfer form of radiation such as gamma radiation. Novel anti-microbial silver materials are defined, characterized by having a positive rest potential, a <math>T_{\text{rec}}/T_m</math> less than 0.33, and a grain size less than 200 nm. Anti-microbial fine grain or nanocrystalline materials are provided, together with methods of preparation, wherein the anti-microbial metal is deposited in a matrix with atoms or molecules of a different material such as other biocompatible metals (ex. Ta), trapped or absorbed oxygen, or compounds of anti-microbial metals or biocompatible metals (ex. Ag<sub>2</sub>O or TaO). The invention also extends to a method of producing an anti-microbial effect with silver materials that form complex silver ions other than Ag<sup>+</sup>, Ag<sup>2+</sup> and Ag<sup>3+</sup>.</p> |  |  |   |

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| <b>(21) International Application Number:</b> PCT/CA94/00604<br><b>(22) International Filing Date:</b> 1 November 1994 (01.11.94)<br><br><b>(30) Priority Data:</b><br>08/154,490 18 November 1993 (18.11.93) US<br>08/154,693 18 November 1993 (18.11.93) US<br>08/154,694 18 November 1993 (18.11.93) US<br>08/190,617 2 February 1994 (02.02.94) US<br><br><b>(71) Applicant (for all designated States except US):</b> WESTAIM TECHNOLOGIES INC. [CA/CA]; Box 1000, 10101 - 114 Street, Fort Saskatchewan, Alberta T8L 2P2 (CA).<br><br><b>(72) Inventors; and</b><br><b>(75) Inventors/Applicants (for US only):</b> BURRELL, Robert, Edward [CA/CA]; 112 Village Downs, Sherwood Park, Alberta T8A 4L6 (CA). APTÉ, Prasad, Shrikrishna [CA/CA]; 34 Langholm Drive, St. Albert, Alberta T8N 3W1 (CA). GILL, Kashmir, Singh [CA/CA]; 58 Malvern Drive, Sherwood Park, Alberta T8A 3W1 (CA). PRECHT, Roderick, John [CA/CA]; 7877 - 26 Avenue, Edmonton, Alberta T6K 3S7 (CA). MORRIS, Larry, Roy [CA/CA]; Rural Route #2, Yarker, Ontario K0K 3N0 (CA). MCINTOSH, Catherine, Laurie [CA/CA]; 713 Georgian Terrace, Sherwood Park, Alberta T8A 2T7 (CA). SANT, Sudhindra, Bharat [CA/CA];   |           | 3431 - 139 Avenue #215, Edmonton, Alberta T5Y 1Z4 (CA).<br><br><b>(74) Agent:</b> OGILVIE AND COMPANY; #1400 Metropolitan Place, 10303 Jasper Avenue, Edmonton, Alberta T5J 3N6 (CA).<br><br><b>(81) Designated States:</b> AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ).<br><br><b>Published</b><br><i>With international search report.</i> |
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| <b>(57) Abstract</b>   |           |  |
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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA 94/00604

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A01N59/16 A61L2/16 C23C14/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A01N A61L C23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|------------|---|-----------------------|
| X          | FR,A,2 634 986 (Y. SHIRO) 9 February 1990<br>see claims 1,2<br>see page 4, line 24 - line 27<br>see page 13, line 1 - line 8<br>--- | 30-46,<br>62-77       |
| X          | GB,A,2 134 791 (VERNON-CARUS) 22 August 1984<br>see claims 1-4<br>see page 1, line 29 - line 41<br>---                              | 30-77                 |
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| X          | DE,U,90 17 361 (H. STREITENBERG) 14 March 1991<br>---   | 30,62                 |
|            | ---   | -/--                  |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

14 February 1995

Date of mailing of the international search report

02.03.95

Name and mailing address of the ISA  
European Patent Office, P.B. 5818 Patentlaan 2

Authorized officer

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA 94/00604

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT |  |                       |
|--|--|-----------------------|
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| X  | EP,A,0 488 269 (MATSUSHITA) 3 June 1992<br>see claim 7<br>---  | 17-19                 |
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Information on patent family members

International application No.

PCT/CA 94/00604

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information on patent family members

International application No.  
PCT/CA 94/00604

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